

# Math 120A Exam I

Fall 2004, Thursday October 21.

Section: \_\_\_\_\_ Name: \_\_\_\_\_

## Instructions:

- You have 50 minutes for this exam.
- One 8.5 by 11 inch page of handwritten notes (front and back) is allowed.
- Write your name and section on your page of notes. Turn your page of notes in with your exam.
- Calculators (scientific or graphing) are allowed.
- You must show your work for full credit. Answers obtained by guessing or reading a numerical solution from a graph on your calculator when an algebraic method is available do not receive full credit.
- Clearly indicate your answers (e.g., by boxing them).
- There are 4 problems, and 5 pages to the exam. Check to make sure your exam is complete.

Problem	Total Points	Points
1	10	
2	10	
3	10	
4	10	
Total	40	

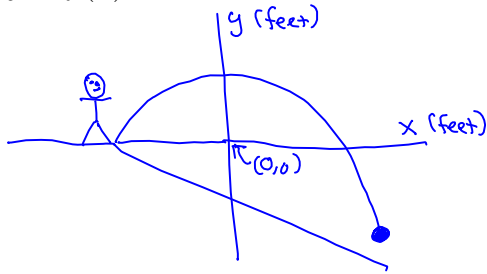
**Problem 1.** Johnny's sailboat is sitting still in the water 5 miles North and 3 miles east of the city of Kingston. A Ferry has just left Kingston and is traveling on a straight line to a port city that is 10 miles east and 2 miles north of Kingston. The Ferry travels at 13 mph.

(a) Where will the ferry be when it is closest to Johnny's sailboat?

(b) After the ferry leaves Kingston, how long will it take before the ferry reaches this location that is closest to Johnny's sailboat?

(c) If Johnny has a radar that lets him detect any ships within 4 miles of his position, will he be able to detect the ferry?

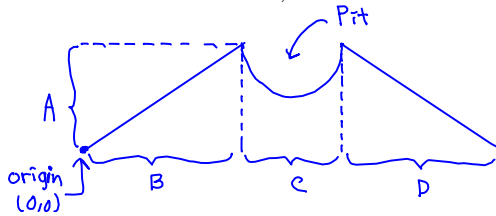
**Problem 2.** Berry is standing 10 feet west of the origin in the coordinate system shown below. Starting at this point, the ground slopes downward, with the ground level being given by  $y = \frac{-4}{9}(x + 10)$ . Berry kicks a ball westward and the ball follows the graph of  $y = f(x) = -x^2 + 2x + 120$ .



(a) Where does the ball land on the slope?

(b) What is the maximum height of the ball above the slope?

**Problem 3.** The vertical cross section for a volcano is given in the following picture. The origin is at the lower left corner of the picture. The sides of the volcano are line segments, and the pit of the volcano is a semicircle (half of a circle). The lengths in the diagram are  $A = 3.96$  kilometers,  $C = 2.13$  kilometers, and both  $B$  and  $D$  are 4.57 kilometers.



(a) Find a multipart function that models the vertical cross section of this volcano.

(b) Suppose the pit of the volcano is filling with lava. The lava rises at a rate of 30 meters per minute. How long will it take for the lava in the pit to be 1.22 kilometers wide? (The lava rises from the bottom of the pit, not the bottom of the volcano).

**Problem 4.** Two cars start out 3 miles apart, with one being directly east of the other one. The cars head in opposite directions (one car heads directly North and the other car heads directly South). The North bound car has a speed of 35 miles per hour. The speed of the South bound car is unknown, call this speed  $v$  miles per hour. (Assume  $v$  is a positive number).

(a) What is the function,  $d(t)$ , that gives the distance between the cars in miles, when  $t$  is in hours? Your answer will involve the unknown parameter  $v$ .

(b) If 42 minutes later, the cars are 50 miles apart, what is the speed of the South bound car?